Note of Interest - N69 Uses for Apollo 15

The combination of the easterly location of the Hadley site and the relatively rough terrain have necessitated several changes to the descent procedures in the area of N69. It should be pointed out and stressed that while these procedures minimize landing dispersions in the eventuality of PGNS navigation problems, they do not, by themselves, loosen the descent abort limits which have been in effect since the pre-Cambrian days of Apollo 11, 12, and 14. These procedures are intended to handle dispersions resulting from less than abort limit failures. The existing limits are being reexamined in an effort to make them as large as prudently possible without violating the principle of maintaining PNGS abortability. These new limits will be published in the Apollo 15 mission rules document when they become available.

The following is a list of the N69's which we intend to use on Apollo 15. This list contains names for each of the parameters as well as what goes into their computation and the reason for the use. Personal druthers for naming these quantities are welcomed.

a. BKUP RLS_2 (three components) - This will be a three-component readup and will be used in the eventuality that the ground is unable to command the RLS_2 and SV_2 loads to the PGNS. For this situation, the RLS_2 normally sent will be modified to reflect two-rev propagation instead of the usual one-rev correction and the result will be transformed into the platform (landing site) coordinate frame. The modification is required because if we cannot get RLS_2 into the PGNS, we will probably not be able to transmit SV_2 and, thus, descent will be performed on SV_1 which will be two revs old. BKUP RLS_2 will only be used if the MSFN cannot load RLS_2 via command load and RLS_1 did not reflect a set of low altitude landmark sightings. (SV_1 and RLS_1 are acceptable for descent as long as RLS_1 contains a valid set of low altitude landmark sightings.) In the event of command problems, BKUP RLS_2 will be voiced up and entered prior to the crew calling P63. This will be a three-component readup.

b. N69 NOMINAL (Z component only) - This is the downrange propagation correction which we have been using since Apollo 11. Its purpose is to correct any SV propagation errors incurred prior to PDI. The correction will be based on either the powered flight processor or MSFN doppler residuals. It will be voiced to the crew at PDI+2 mins for incorporation ASAP. This is a one-axis update, downrange.

c. N69 DOWNTRACK NAV (Z component only) - This is a correction to compensate for a downtrack position error incurred by a downtrack accelerometer bias. By measuring a confirmed PGNS nav error at PDI+2 mins, the downrange position error at the time of velocity convergence can be estimated. This assumes linear error growth and considers the effective error during LR velocity correction. The estimated error with its sign reversed is voiced to the crew for input to the PGNS at PDI+5 mins.

d. N69 CROSSTRACK NAV (Y component only) This is a correction to compensate for a crosstrack position error incurred by an out-of-plane accelerometer bias or platform misalignment. It is computed in the same manner as the N69 downtrack nav and is voiced and input at the same time as the downtrack correction.

e. N69 RADIAL NAV (X component only) - This correction compensates for altitude errors resulting from either a navigation error during powered flight (e.g., an accelerometer error) or an $\dot{h}$ error at PDI. This $\dot{h}$ error can stem from a downrange position error which results in the PGNS having an error in its knowledge of local vertical and thus, an $\dot{h}$ error. The computation of this parameter is essentially the same as for the preceding two parameters, except that the position error is a function of two velocity errors--one being the downrange propagation error and the other the vertical navigation error. This correction will be voiced to the crew only if we are fairly certain we will not have landing radar data prior to pitchover. The correction is not required as long as we have LR, because the LR will square away any radial position error after incorporation. It should be pointed out that if this correction is applied with subsequent LR acceptance prior to the time for which the correction is computed, a Δh will be introduced. This Δh will be converged the same as any other Δh. This correction will be voiced up at PDI + 7 mins for input at PDI + 8 mins.

Please feel free to comment on this proposed plan including the names we intend to use in real time. Comments should be addressed to either Will Presley at extension 3268 or Jay Greene at extension 2538.

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